NASA SBIR/STTR Technologies

T3.01-9994 - MEMS Based Solutions for an Integrated and Miniaturized Multi-Spectrum Energy Harvesting and Conservation System

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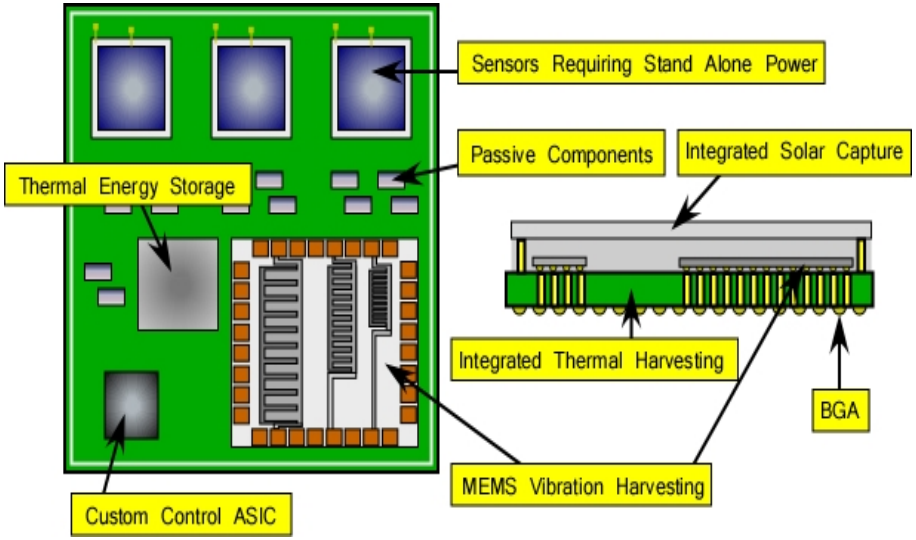
Identification and Significance of Innovation

The objective of this proposal is to develop three unique energy harvesting technologies utilizing our existing research strengths that will be of interest and utility to NASA applications and environmental conditions. By developing multiple technologies, NASA will be able to harvest energy from multiple waste energy sources, namely environmental vibrations, thermal energy, and solar flux. These devices were initially developed separately during Phase I with integration into a single packaged device occurring during Phase II. Since the research on these technologies has been ongoing, it is reasonable to enhance the initial prototypes of these technologies and integrate the entire system during Phase II. The proposed integrated energy harvesting concept device is shown below in Figure 1.



Estimated TRL at beginning and end of contract: (Begin: 4 End: 6)

Technical Objectives and Work Plan

The primary goal of Phase II activities will be to enhance the transducers that will harvest energy from environmental vibrations of machines, aircraft, satellites, and the launch environment, thermal energy retained in launch structures, the ambient environment, and operations equipment, as well as solar energy collection enhanced by surface plasmons and integrate them using the latest in packaging technologies. The major requirements and specifications of the effort are listed below.
1) Enhancement and development of the individual transducers' behavior and performance.
2) Fabrication of the transducer devices.
3) Testing and characterization of the devices.
4) Development of the interfacing circuitry and packaging platform.
5) Integration of these devices for demonstration.

The work in this project will be divided between Radiance Technologies (60%) and Louisiana Tech (40%). Tech will be responsible for studying and creating the transducers portion of the project including modeling and simulation and fabrication. Radiance will design and fabricate the electronics interfacing with the transducers, assist with transducer fabrication when necessary, and manage the overall progress of the project.

NASA Applications

This program has application to the current NASA mission. This proposal targets many of the technical challenges outlined in the NASA Space Power and Energy Storage roadmap. All technologies which support the Outer Planetary and Inner Planetary missions as well as the Space Operations Mission directorate require new methods of power and energy storage. The technology proposed here would harvest energy from the ambient environment facilitating a reduction in dependence on primary power sources.

Non-NASA Applications

This program has commercial applications in addition to those which benefit the current NASA mission. Energy and power are at the forefront of every discussion related to advancing microelectronics and systems such as in wearable electronics. Additionally monitoring the health of electronic and mechanical systems has proven to be an emerging need across many military and commercial systems alike.

Firm Contacts

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